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Effect of charge on membrane rejection during ultrafiltration: Comparison of dextran and carboxymethilcellulose (CMC) solutions

M. Pinelo, O.A. Prado, V. Møller, A. Meyer, G. Jonsson*

Technical University of Denmark, Denmark

Both dextran and CMC are linear polymers composed of glucose units. However, the presence of carboxyl groups in CMC confers a certain charge density on the molecule, which can be controlled via pH. During dead-end concentration of 40 g/L solutions of CMC and dextran, a rejection of ~0.9 was observed for CMC, whilst a rejection of ~0.1 was found during dextran concentration at the same operational conditions i.e. pressure, pH, temperature and MWCO. Results suggested that dextran filtration followed the osmotic pressure model, whereas the cake filtration model explained CMC concentration. Such different behavior was ascribed to the diverse capacity of aggregation of solute particles, which resulted in a different concentration polarization pattern and in turn, in a different fouling mechanism. Fouling patterns for both oligosaccharides were compared to the one followed during concentration of bovin serum albumin (BSA), whose charge density resulted in high protein aggregation and immediate external fouling. The results showed in this study help to better understand the influence of charge in the mechanisms behind concentration polarization and fouling, which strongly influence flux and rejection during concentration of oligosaccharides.

Keywords: Ultrafiltration, Carboxymethylcellulose (CMC), Dextran, Charge

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